Comparison of performances of three active layers cascade OPVCs with those obtained from corresponding bi-layers

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Auteur	Cattin, Linda [1], El Jouad, Zouhair [2], Arzel, Ludovic [3], Neculqueo, Gloria [4], Morsli, Mustapha [5], Martinez, Francisco [6], Addou, Mohammed [7], Bernède, Christian [8]
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Mots-clés	band structure [9], Phthalocyanine dye [10], Ternary organic solar cells [11], Thiophene derivative [12]
Résumé en anglais	In this study, organic photovoltaic cells based on planar heterojunctions using small-molecules were fabricated. Two cell configurations were used, planar heterojunctions based on a classical electron donor/electron acceptor couple and planar heterojunctions using three active layers, one donor, one acceptor and a central ambipolar layer. The donor is a thiophene derivative called BSTV, the acceptor is the fullerene while the ambipolar material is a phthalocyanine dye, the SubPc. After studying the performances of cells based on the couples SubPc/C60, BSTV/C60 and BSTV/SubPc, we explore the dependence of the short circuit current and the external quantum efficiency on the SubPc interlayer thickness in cells with three active layers. By comparison with the optimum couple SubPc/C60 the ternary structure BSTV/SubPc/C60 exhibits higher short circuit current but smaller fill factor. Nevertheless, for an optimum interlayer thickness of 12.5 nm, the ternary structure allows an improvement of the cell efficiency of 11% by comparison with the highest result obtained with the best couple. As shown by optical measurements, long range Föster energy transfer from the larger band gap donor, BSTV, to the smaller band gap, SubPc, is possible. Therefore, the increase of Jsc is attributed to two-step exciton dissociation process. Excitons produced in the outer BSTV layer are transferred to the SubPc central layer and then dissociated at the interface.
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